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ABSTRACT

Activities were provided for a target group of third grade students who were experiencing difficulty in mastering the skills required to solve problems involving money. The program's aims were to remediate these students by giving them the opportunity to use instructional software that would increase their mathematical vocabulary, strengthen the logic behind their thought patterns, and assist them in mastering the skills necessary to solve word problems with confidence and success. Developed and implemented was a computer program that included reading, understanding, analyzing, estimating, and computing with regard to the solving of word problems having to do with money and the making of change. Each of the students in the target group was given a pretest, an attitudinal survey, and a posttest. Results indicate that the students in the target group improved their ability to solve word problems concerning money and the making of change. The attitudinal survey indicated that the students gained both confidence and a feeling of success. Included in this study are the purpose, research, method, results, and recommendations. Appended are the minimal standards for the county and state in which the research was done, sample tests, parental survey form, software evaluation form, letters from both principal and teachers, and a documentation packet on the computer program that was used. (KR)

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THE EFFECTIVENESS OF COMPUTER ASSISTED INSTRUCTION ON CHILDREN'S MATHEMATICAL PROBLEM-SOLVING ABILITY

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By

AMY D. PETTIT

A Practicum Report
submitted to the Faculty of the Center for the Advancement of Education of Nova University in partial fulfillment of the requirements for the degree of Master of Science.

April/1986

AUTHORSHIP

I hereby testify that this paper and the work it reports are entirely my own. Where it has been necessary to draw from the work of others, published or unpublished, I have acknowledged such work in accordance with accepted scholarly and editorial practice.

I give this testimony freely, out of respect for the scholarship of other workers in the field and in the hope that my own work presented here will earn similar respect.

Amy D. Pettet

ABSTRACT

The Effectiveness of Computer Assisted Instruction on Children's Mathematical Problem-Solving Ability.
Pettit, Amy D., April 1986. Practicum Report, Nova University, Center for the Advancement of Education
Descriptors:Addition/Arithmetic/Computer Assisted Instruction/Computer Literacy/Computer Programs/Computers/Computer Science Education/Educational Research/Elementary Education/Elementary School Mathematics/Individualized Instruction/Instructional Materials/Learning Problems/Mathematics Curriculum/Mathematics Education/Mathematics Instruction/Motivation/Primary Education/Problem Solving/Student Motivation/Subtraction
The author provided activities for a target group of third grade students who were experiencing difficulty in mastering the skills required to solve problems involving money. The program's aims were to remediate these students by giving them the opportunity to use instructional software that would increase their mathematical vocabulary, strengthen the logic behind their thought patterns, and assist them in mastering the skills necessary to solve word problems with confidence and success.

The author developed and implemented a computer program that included reading, understanding, analyzing, estimating, and computing with regard to the solving of word problems having to do with money and the making of change. Focus was placed upon the importance of estimation in developing the thinking skills necessary to achieve success in solving word problems. Each of the students in the target group was given a pretest and an attitudinal survey. Records of student performance were stored to disk automatically. Each student was then given the opportunity to view the computer program and work on an individualized basis with the author. The students also received instruction in vocabulary. Parents were asked to provide written documentation concerning activities performed at home. At the end of the instructional period, the posttest and the attitudinal survey were administered to all students in the target group.
Results of the posttest indicated that the students in the target group improved their ability to solve word problems concerned with money and the making of change. The attitudinal survey indicated that the students gained both confidence and a feeling of success. The computer program was shared with other teachers in the school. It was also donated to the public domain catalog of the school district in which the author teaches so that other county teachers would have the opportunity to use it with their students. (Appendices include county minimum standards, state minimum standards, attitudinal questionnaire, sample tests, parental form, software evaluation form, and letters from both principal and teachers.)

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I have observed Mrs. Pettit in her implimentation of the activities discribed in her practicum. She has been working with the students in my class whose test scores indicate the need for remediation in the skill area of money and making change.

Practicum Title The Effectiveness of Computer Assisted Instruction on Children's Mathematical Problem-Solving Ability

Student's Name Amy D. Pettit

Program Site Tropical Elementary Date June 18,1985

Observer's Name Patti Fitzgibbon Patti Fitzgibbon
(please print ----------and sign)

Observer's position Classroom Teacher- Third Grade

PURPOSE

The writer, an elementary school teacher, was on professional leave from formal teaching duties to pursue an advanced degree and was a volunteer at an elementary school that was in close proximity to the author's home. The school was located in a metropolitan area which consisted of single family homes in which primarily upper and middle income families resided. There was one apartment complex within its boundaries. There were a total of 502 students enrolled for the 1984-1985 school year: 47 were Black, 5 were Asian, 6 were Hispanic, and 444 were Caucasian. Bus transportation was provided to students who resided more than two miles away from the school and to children whose walking to school would prove a hazardous condition.

The number of personnel assigned to the school was 47. The writer assisted one of the three third grade classroom teachers during the time allotted for mathematics instruction. Although most of the students in the class were of average ability, the class ranked as the lowest of the three third grades in the school. The children in the class usually required assistance with fundamental computation as well as with the mathematical vocabulary needed to perform simple mathematical operations. A majority of the time allotted for mathematics was being spent in computational drill rather than in problem solving and application. The teacher-pupil ratio of 28 to 1 did not permit

ample time for individual assistance; thus, many of the students did not obtain the help that they required.

The physical layout of the school was 'open'. Although there were some partitions to separate major areas, there were no walls to divide each individual classroom. The focal point in the large classroom area was the media center that was available for all students to utilize. There were closed classrooms for the computer lab, the school counselor, and the learning disabilities teacher. There were separate areas set aside for the administration and faculty. There was also a school cafeteria.

The school population consisted of children in kindergarten through Grade five. The teachers utilized concepts conducive to an open classroom situation including team teaching, cross grouping for reading and mathematics, and individualization when possible. Instructional aids were used to facilitate learning. The school placed primary emphasis on instruction in the basic skills of reading, language arts, mathematics, science, social studies, and reference skills.

The academic success of the students in the school was a priority among the parents of the children. Expectations for academic achievement were of prime importance. Parental involvement played a significant role in the educational and academic progress of the children. Parent volunteers logged over 3000 hours during the 1983-84 school year, earning the school the Golden School Award. Volunteer parents fully staffed the computer lab with the assistance and guidance of the Primary Specialist and the part-time computer teacher. All of the

students received computer instruction, resulting in a computer knowledgeable student body.

The Florida State Board of Education required that a statewide assessment test be given to all third graders during the month of October in the areas of reading, writing, and mathematics. The purpose of the test was to ascertain those students who required additional instruction to meet the minimum standards established by the state. The results of the test also assisted teachers in knowing the specific skills that needed attention so that effective remediation techniques could be applied during the school year. For the student to be promoted, mastery had to be achieved in each of the required skill areas. One of the problem areas in mathematics was the specific skill that pertained to solving word problems involving the use of money. The student had to determine the change to be received from monetary amounts of up to 50 cents after the purchase of two items. This was the last of 13 skills pertaining to mathematics that had to be mastered for promotion from third grade (Appendix A). In addition to being a minimum standard requirement set by the State of Florida, this skill was also a minimum basic skill required by the school board of the county in which the school was located (Appendix B). State adopted math textbooks included various exercises on money and making change at this grade level, again indicating that this was an important skill to be mastered.

After reviewing the Minimum Student Performance Standards Test results with the Primary Specialist and the third grade classroom teacher whom this writer assisted, it was determined

that there existed an immediate need to improve the students' ability to pass the minimum standards set forth by the State of Florida in the area of money and making change. For two consecutive years, 1982 and 1983, the test results indicated that the students scored lower on this specific skill than any other test item given. Based on the results of the State Assessment Test given in October of 1984, only 67% of the third grade students in the class with whom this author worked achieved mastery of this skill. The results of the test scores in all the areas of mathematics are shown in Table 1. This author was concerned with skill number 13.

Table 1

Percentage of Students Achieving Success in Math Skills on the State Assessment Test

Skill Number	School	Class
1	99%	100%
2	99%	96%
3	97%	96%
4	88%	89%
5	96%	96%
6	88%	74%
7	89%	85%
8	95%	96%
9	93%	85%
10	97%	93%
11	99%	96%
12	92%	89%
13	78%	67%

It is interesting to note that the overall student body also did poorly on skill number 13 as compared to the rest of the items on the test. Thirty-three percent of the writer's class failed to achieve mastery of word problems involving money and making change. This was well below what was expected of these students. The majority of these students came from a culturally advantaged background. A high priority was placed on academic success. It was unacceptable that these students did poorly on any of the minimum standards. It was evident from the test scores that the students experienced difficulty with computation as well as problem solving when trying to evaluate and solve the mathematical word problems dealing with money.

Math was taught on a daily basis for 45 consecutive minutes in compliance with the time requirements set forth by the county school board. All of the students in the third grade were cross-grouped into three homogeneous classes for math. The math class that this writer worked with was the lowest of the three groups. There were 28 students in the class. The students in this group lacked the skills needed to read and interpret word problems as well as the ability to apply math skills to real-life experiences. The majority of the time in math class was spent in computational drill, rather than in application of mathematical knowledge and skills to practical situations. This resulted in a lessening of the ability to adequately solve word problems.

All of the standards on the Minimum Student Performance Standards test had to be mastered by each student before

entering fourth grade. The target group for this practicum consisted of those nine children who did not correctly answer the problems on the third grade Minimum Student Performance Standards Test having to do with money and the making of change. An attempt was made to help these students master this skill in the most efficient manner. This writer assumed that the use of instructional software was the most efficient and beneficial way to promote learning. The Primary Specialist, the classroom teacher whom the writer assisted, and the computer teacher all indicated that the children in the target group were in need of assistance. No software was available in the school for this purpose (Appendix D contains letters from these teachers). There was also no money available for the purchase of software (see Appendix C for principal's letter).

The success or failure of the learning enviornment rests on the teacher's ability to encourage curiosity and interest. It is in this dimension that the writer attempted to motivate these students to correctly identify the elements necessary to solve word problems with ease and success. These students received individual instruction and assistance in an attempt to improve their computational and problem solving skills so they could pass the aforementioned skill on the Minimum Student Performance Standards Test.

In order to remediate the aforementioned problem, the following objectives were set:

1. After the implementation period, the students in the target group would master the skills with 80 percent accuracy as measured by a posttest that was included in the computer

program. The specific skills presented in the computer program were:

a. The students would determine the change to be received from up to 50 cents after the purchase of two items.

b. The students would subtract to solve practical money problems of not more than 50 cents.

c. The students would apply problem-solving techniques to perform math operations appropriate for their grade level.

2. There would be an improvement of 10 percent in the mean of the posttest over the mean of the pretest.

3. The students in the target group would demonstrate a positive attitudinal change with respect to their own ability to solve word problems dealing with money and the making of change as measured by a pre and post questionnaire. (The questionnaire is in Appendix E).

RESEARCH

The development of the student's ability to solve word problems is a major objective of the mathematics curriculum in the elementary school. The child continually encounters situations in school and in daily life that requires understanding, analyzing, and making intelligent choices. The understanding, logic, and computational knowledge necessary to accurately solve problems dealing with money is largely dependent upon the problem-solving techniques and competencies of the individual student. It involves the interrelationships of many logical and sequential steps, all of which are important for the purpose of arriving at an answer in which the internal procedures are as important as the answer itself. This writer's research focuses upon the establishment of credibility to the idea that the student's ability to solve verbal problems is more likely to occur when the student can relate learning to a real need or purpose.

Piedmonte (1981) in his article, "The Crusade for Problem Solving in Mathematics Education", states that math education has neglected to develop problem-solving strategies that can be used outside the classroom. Participants at the 1980 National Council of Teachers of Mathematics (NCTM) recognized the improvement of problem-solving skills as the single most pressing curriculum issue facing math teachers in the 1980s. This recent trend toward the teaching of problem-solving is necessary to help students understand and develop the cognitive processes necessary to be successful with math. At the last

council meeting it was emphasized that problem-solving involves applying mathematics to the real world. It was agreed that the elementary mathematics curriculum sequence needed to be redesigned to realize the critical process goals of problem-solving, as well as the content and skill goals. The Council encouraged the elementary school to lay a foundation of skills with an interplay of skill-building and application. The evaluation of programs with problem-solving goals needed to be sensitive to the nature of these ideals. Too often tests, rather than the needs of the students, dictate the programs and curriculum. Members of the NCTM stated that teaching the skills necessary for problem solving is one of the most difficult tasks facing a teacher. Some of the reasons for the difficulty are: (a) all the students in a given group are not familiar with the necessary content needed to solve the problem, and the teacher is then faced with the problem of how to handle the diversity of backgrounds; (b) students work at different rates, and this is especially true in the case of problem solving; (c) there are many ways to solve the same problem, and the teacher must take into account what each student is trying to accomplish; and (d) students must rely on past mathematical knowledge to arrive at a correct solution, and very often these skills have been forgotten.

In the article, "Analyzing Changes in Student Math Achievement", (The National Assessment of Educational Progress [NAEP], 1979), the mathematics abilities of students were surveyed at four cognitive process levels: knowledge, skills, understanding, and application. The panel was highly concerned

with the generally low performance of the students on problem-solving. One of the factors pinpointed as contributing to this decline was the back-to-basics movement that stressed routine lower-level skills rather than analytical and critical thinking skills: the result was less emphasis on problem-solving. Textbooks that came into wide use in the 1970s adopted a simplified approach to problem-solving (e.g.:"23 horses. 8 taken away. How many left?"). Students did not gain experience in using analytical and critical thinking skills. In conjunction with the textbooks, the development of a mechanistic approach to problem-solving taught students to look for "key" words to decide which operation to use. This eliminated the need to understand the problem or to "think" of how it should be solved. In light of the data, the following recommendations were made: (a) textbooks should be modified to contain a greater variety of problem-solving tasks, (b) the teaching of problem-solving should receive more emphasis, and (c) the ability to analyze a problem should be equally as important as the correct solution.

This writer contends that much of the difficulty students have with problem solving stems from their failure to understand the problem itself. In exercises where extraneous information was given in the problem statements, many students merely used all of the numbers given in some way, indicating a lack of understanding of the problem. Instruction should include slow down mechanisms to motivate students to make a concerted effort to understand what is being asked. The student should have the opportunity to break the problem apart

by asking the question, "What do I need to be able to continue to solve this problem?" Too much emphasis is placed upon computational drill which may actually be counterproductive to the development of the flexibility needed for problem-solving.

Scheffler (1980) explains a new approach to teaching problem solving. The system is called Diagnostic Prescriptive Arithmetic (DPA). It is the work of Matthew Scaffa, Math Supervisor of Staten Island's Community School District. This program teaches specific arithmetic skills with an emphasis on practical application and problem solving skills. The approach consists of breaking down the processes and concepts of the problem into more steps in conjunction with materials that the students can physically manipulate. The program is a step by step approach, starting out at a very concrete level and working up to abstract ideas. Word problems are built around the personal happenings of the children. The use of estimation skills while promoting application of problems to everyday experiences is a feature of the program. Students using DPA showed a surprising gain of 15 months in test scores for seven months of instruction. The program has become widely adopted in the Staten Island district.

Another method proposed by Moses (1982) in the article "The Visualization Approach to Mathematics Problem-Solving" (1982) is the use of visual thinking. Visual thinking involves three strategies of thought: seeing, imagining, and designing. Moses states that the overemphasis on computation and drill in the elementary mathematics curriculum appears to be taking its toll on the problem-solving performance of students. The

alternative approach offered is to teach problem-solving by focusing on mental images, to translate those images to drawings, and then to analyze those drawings in terms of the questions asked. The author feels that this new direction in thinking will benefit students of low reasoning ability by giving them a viable alternative. It will also provide any student with a better perspective of the problem situation.

Krulik and Rudnick (1984) suggest the use of games to strengthen the skills children need in order to solve word problems. Besides enjoying the games, the child can subtly be lead to investigate new techniques that involve active rather than passive learning. The games must meet five criteria that are set by the author. The games should be for two or more players. They should have a set of rules that place the players in conflict with each other. The rules should establish goals for the players. The players should be able to choose their own path of action to reach their goal. It should be apparent when one of the players has won. The logic behind the use of games to improve problem-solving skills is that both require careful analysis by the student as well as carrying out a strategy and checking the results. Teachers should guide the atmosphere to one that encourages thinking and discussion. The discussion provides the key to the transfer from strategy gaming to problem solving. It gives students the opportunity to concentrate on developing strategies for future use. Krulik and Rudnick contend that this strategy proves to be a valuable addition to a collection of strategies for the teaching of problem-solving, a critical skill.

Kelmar et al.,(1983) state that, "As the computer becomes a valuable tool for all of education, perhaps it will be most valuable in the learning of problem-solving" (p.65). This writer agrees that many of the problems facing teachers can be solved through the use of computers. Computers cannot solve everything encountered in the teaching of problem-solving, but they can provide support in many areas. The students can progress at their own pace, taking as little or as much time as needed on any particular problem. The computer enables a student to request hints or cues, as needed, that may have been forgotten or possibly never learned. The computer can provide for educational differences and preferred learning styles on the part of the student. The computer can provide feedback to the student as well as the teacher concerning the many aspects of a particular student's problem-solving capabilities.

Hassett (1981) states that "One advantage of presenting material on a computer rather than through a textbook or an overhead projector is that a computer can ask questions as it goes along. In theory, this means that instruction can be tailored to each student's knowledge and abilities in a way that will increase motivation, attention and learning" (p. 24).

The author of this practicum feels that computer lessons should be developed and programmed so that they provide the student with immediate feedback and reinforcement. The student should have the opportunity to branch to different alternatives depending upon his/her capabilities. This encourages the student to develop a strategy for solving the problem correctly

by exploring the situation, not merely trying to obtain a 'right' answer. The computer program should require the student to assess the situation before attempting to solve it.

Green (1984) cites Skinner's advice for courseware creators,

> The main thing in programming is to break the subject matter up into small steps that are easily taken. The steps should progress so that after you've taken one, you're in a better position to take the next. And of course you need to know immediately whether or not you've been successful. Slowly, you find yourself doing more and more things successfully. Present the material, give the student every help to be right, and then slowly remove that help so that the student is right because he knows the stuff. (p. 28)

Graphics are also considered to be important in that they provide excellent diagrams related to the problems as well as give the student a facsimile of motion in furnishing an alternative to the stationary workbook.

With all this in mind, one would think that the computer could solve all the difficulties surrounding problem-solving. Such is not the case. This writer is in agreement with Hassett's (1984) statements concerning the importance of the role that mass marketing has played to convince teachers that they should accept this new technology. Hassett indicates that teachers should be enthusiastic about computerized education, but, unfortunately, the software that is offered is of such

poor quality that that one cannot but wonder for whom the programmers are writing.

It is in this perspective that this writer attempted to present a solution. By offering software that was both acceptable to the teacher and usable by the student, the writer desired to ensure that learning occurred in an atmosphere that would be child-centered and individualized. For those children who were intimidated by the classroom situation, the computer would be less judgemental and more private. It was the goal of the writer to provide success to the student by presenting problem-solving techniques in a structured situation so that optimum success could be achieved. The writer used various methods and procedures and incorporated them into a meaningful whole. The computer program ensured success by providing a format whereby the student had to understand, analyze, and then decide. Kelmar et al., (1983) states that the "computer is exceptionally well suited to the creation of problem solving situations that are unaccessible in the real world, and that allow convenient observation of the process the child uses to solve problems" (p.158).

It is encouraging to know that the emphasis in the 1980s will be on problem-solving and application of problems to real life situations. In reviewing the mathematics textbooks that were to be considered for adoption for the school year 1985-86 by the state of Florida, the writer observed that each textbook provided a special section within the textbook itself or a supplementary book entirely devoted to the area of problem-solving. Researchers are giving much attention to

problem-solving, but a concerted effort is needed by each school district if teachers are to actively engage each student in this form of learning with some degree of success.

After taking into consideration all the research that had been gathered, the writer determined that there was a definite need to provide instruction in problem-solving. Although many state-adopted mathematics textbooks included various exercises on problem-solving with a few problems devoted to money and the making of change, the frequency of the lessons within each book appeared to be inadequate. The research indicated that the need to teach this skill was a widespread problem; therefore, the strategies offered in this practicum can be used by not only the teachers at the writer's school, but by those at other teaching institutions as well.

The combination of a limited amount of funds for purchase of computer software in the school, and the fact that appropriate commercial software was not available largely determined the necessity for developing an original computer program to be used by the students in the target group. The use of the computer was the best means of presenting the material. It was necessary for each child to acquire the skill of making change in order to be promoted to fourth grade. The computer enabled this requirement to be fulfilled in the shortest and most efficient amount of time. Computer programs require answers on the part of the learner; thus, the students could not waste the time given to them. In many of the studies read by the writer, it was noted that children do learn more efficiently and more quickly through the use of the computer.

The writer taught the students a structured but flexible approach to problem-solving through the use of computer software that dealt with one area of problem-solving, that of money and making change. The author wrote a computer program that fulfills the specfic need for good educational software to teach this skill. The instruction offered by the computer program is tailored to increase motivation, attention, and learning. The author's computer program stresses reading, understanding, analyzing, estimating, and computing with regard to the solving of word problems having to do with money and the making of change. Judging the reasonableness of an answer, visualizing a problem, and choosing the correct operation are also included and presented.

The writer used the following strategies in an attempt to improve the performance of students:

1. Students were given the opportunity to see and understand the meaning of the fundamental operations and the interrelationships between these operations. Skills previously learned and those currently being studied that had a relation to computation in addition and subtraction were reviewed.

2. The writer enriched the students' knowledge of mathematical vocabulary prior to the students' use of the computer program. The students were taught to read and understand the meaning of the following words: change, estimation, and think.

3. The writer attempted to build positive attitudes toward problem-solving with relation to problems involving

money. An attitudinal survey was given to the students before the use of the computer program and again after its use to see if any attitudinal change had occurred. (Appendix E contains the attitudinal survey questionnaires and Table 3 shows the results of this survey).

4. Parental involvement was attained through reports concerning student progress (Appendix G).

5. The students became aware of the educational value of computers. Their involvement with this study assisted them realizing that computer programs could help them to extend their knowledge, as well as to strengthen skills previously learned.

As an integral part of the solution strategy, an instructional computer program, written by this author, was utilized. Each child received individual attention by this writer in conjunction with the instructional program.

The computer program accomplishes the following:

1. The word problems utilized are appealing to the age level for which they are intended. The problems deal with high-interest, applied topics and focus on real-life situations. The author discussed the contents of the word problems with the students prior to writing the instructional computer program.

2. Students are given ample time to devote to problem-solving, each working individually at his/her own rate.

3. Students are encouraged to use a variety of different methods for solving a problem so that they can have a better chance of becoming a good problem solver. Some of the methods

included in the computer program are the use of pictures, diagrams, and patterns.

4. Students learn how to estimate answers to word problems.

5. Students are given the opportunity to solve problems involving situations that demand analytical thinking. An inductive step-by-step approach on a one-to-one basis is utilized. The student is guided into a better understanding of the process of how to solve the problem. The lessons are structured carefully to ensure maximum learning.

6. The computer program requires that the student use visual thinking to enhance the mental computation that is necessary to solve word problems dealing with money.

7. The student has to read the problem. The students need to be able to locate the pertinent information in the problem and discard what is irrelevant.

The main concern of the writer in the implementaion of this study was to detect errors as students solved monetary word problems and then to assist them in correcting these errors. In dealing with problem-solving, the writer concluded that there was no one 'right' way to solve problems. Positive reinforcement was given for any strategy that worked for a particular student, even if the strategy seemed inefficient. The writer attempted to make an individual diagnosis of each student's approach to the solving of a problem. An attempt was then made to correct the thought patterns and, if necessary, the errors in computation.

The students were informed as to why they were chosen for this instruction. It was explained that they had to achieve certain standards for promotion to fourth grade. The students were given the necessary instructions for using the computer program involved in this study.

The specific responsibilities of the writer were to:

1. Perform the tasks necessary to implement this study.

2. Administer the pretest to those students who were identified as being in the target group.

3. Administer the attitudinal survey to the students in the target group at the commencement and culmination of the study.

4. Instruct the students in the target group using the computer software designed by the writer.

5. Administer the posttest to the students in the target group after instruction was completed.

6. Have two teachers evaluate the software designed and written by this writer. These evaluations are discussed in the results section of this report. Appendix H contains the evaluations.

The writer of this study worked with the third grade teacher who was responsible for mathematics instruction. The primary location for implementation was the computer laboratory of the school. Arrangements were made by the classroom teacher for the writer to use the laboratory.

The writer acted as a supplementary resource person for any students in the target group who required additional assistance. Students were given ample time to think about and

perform the necessary activities required to complete the questions on the computer program.

Progress of the students was monitored continuously as they completed the problems presented in the computer program. As the students progressed through the program, they received immediate positive reinforcement or re-teaching. Monitoring also consisted of sample questions administered to the students to determine if any re-teaching was necessitated (Appendix F contains a sample question sheet). The questions presented resembled those on the Minimum Student Performance Standards Test administered in October.

Example 1. John has 25 cents to spend. If he buys gum for 17 cents and candy for 8 cents, how much money will he have left?

Example 2. Mary went to to the store and bought bread for 24 cents and a can of peas for 19 cents. How much change did she get back from 50 cents?

In most of the problems the students had to first determine how much they had spent by adding the cost of the bought items. Then they had to subtract this total from the original amount that was had to spend. Prior to computer instruction given by the writer of this practicum, many of the students would simply add or subtract any of the given numbers within the problem to arrive at any answer, rather than think out the problem first before responding.

Data collection was also accomplished through the use of teacher observation, the student attitudinal survey, the administration of the pretest and the posttest, and the

comparison of the scores on the pretest with those of the posttest.

The nine students in the target group received instruction 3 days per week, 45 minutes per day, for 6 weeks. The following considerations were kept in mind:

1. The students were given problems that dealt with situations within the scope of their experiences.

2. The necessity for a specialized vocabulary was emphasized.

3. The student was encouraged to think the problem through before computing.

4. The answer to the problem was achieved by estimation.

Listed below are sample questions and tasks that were asked of the students as they progressed through the computer program.

1. What information does the problem give you?

2. What does the problem tell you to find?

3. What must you do to find the answer?

4. Estimate what the answer might be.

5. Now do the problem.

The following timeline was adhered to:

Weeks One To Four

The writer planned, developed, and designed a computer program and the appropriate documentation. The program was consistent with teaching methods as discussed in the research section of this report.

Week Five

The writer discussed the objectives of the study with the students. The nine students were told why they were selected for this study.

Parents were informed of the project. Their participation as resource people at home was solicited. Parents were asked to provide written documentation concerning home activities having to do with this study. Appendix G contains the forms that were used for this documentation.

The writer administered the attitudinal questionnaire to the students in the target group. Appendix E contains this questionnaire. Table 3 contains the results of this survey.

Week Six

The computerized pretest, written by this author, to establish the abilities of the students in the area of money and making change was given to all the children in the target group on an individual basis. The scores were recorded to disk automatically.

Week Seven

Students were instructed by the writer as to the use and care of computer software. The computer program designed by the writer was viewed by all of the students in the target group on an individual basis. Student scores were assessed by the writer so that additional assistance could be given if needed. Parents were asked to reinforce the skills taught and monitor student's progress at home by providing real life experiences that dealt with money and the making of change.

Week Eight

Sample test questions from the Minimum Student Performance Standards Test were given to the students. This author reinforced and reviewed the skills presented. Through oral discussion, the writer determined those students in the target group in need of further instruction.

Week Nine

The computer program was readministered to the nine students in the target group who still exhibited a lack of understanding in the area to be improved. This was done on an individual basis.

Week Ten and Eleven

The posttest computer program was administered to all the students in the target group. This was done on an individual basis. The writer readministered the attitudinal questionnaire to the students in the the target group (See Appendix E for the questionnaire).

RESULTS

At the conclusion of the instructional period, the writer administered the posttest to the nine students in the target group. It was given on an individual basis. It took approximately 2 weeks to administer the posttest to all of the children in the target group. Evaluation ascertained that 7 of the 9 students in the target group mastered the following skills with 80% accuracy: (a) determining the change to be received from up to 50 cents after the purchase of two items, (b) subtracting to solve practical money problems of not more than 50 cents, (c) applying problem-solving techniques to perform math operations appropriate for their grade level. A comparison was made between the scores of the pretest and the scores of the posttest. As was indicated above 2 of the 9 students did not meet the first objective. These students scored very low on the pretest possibly indicating that more remediation was necessary, or that they did not have the basic skills necessary to pass the test. Perhaps the writer was not realistic in expecting that 100% of the students would be able to meet objective one. There was an overall improvement of 47.8% in the mean of the posttest over the mean of the pretest. This improvement was much higher than was expected by the writer, indicating that use of the computer program was beneficial. Table 2 illustrates these results.

Table 2

Comparison of Pretest and Posttest Scores

Student	Pretest score	Posttest score	% improved
A	0%	20%	20%
B	20%	80%	60%
C	30%	60%	30%
D	10%	80%	70%
E	20%	80%	60%
F	30%	80%	50%
G	40%	80%	40%
H	0%	80%	80%
I	70%	90%	20%

Mean of the pretest is 24.4%

Mean of the posttest is 72.2%

Mean increase of posttest over pretest is 47.8%

In addition to the posttest, an attitudinal survey was readministered to all the students in the target group to determine any change in attitude. The results of this survey are shown in Table 3. The greatest change occurred in question number 5. This question is related to estimation. It asks the students to decide whether they know how to estimate when doing math problems. The skill of estimation was emphasized to the students in the target group. Six of the students answered no prior to instruction. All of them answered positively after instruction. This indicated a 67% increase towards a positive response. The second major change in attitude had to do with the students considering math as their best subject. Among those answering, less than half answered positively before instruction. After instruction there was a 44% increase in those that answered yes. Appendix E contains the attitudinal survey questionnaire before instruction. Appendix I contains the attitudinal survey after instruction. The third objective was met by all of the students.

Table 3

Results of Attitudinal Survey

Question	% YES Before	% YES After	Change
1	100%	100%	none
2	88%	100%	12%
3	44%	88%	44%
4	77%	88%	11%
5	33%	100%	67%

Evaluations which were done by two teachers who reviewed the computer program are shown in Appendix H. One of the two evaluations was done by the computer teacher of another school in the same school district. She made a special request to the author so that she was able to use the computer program with her students (see appendix J). She stated that the graphics attracted the students' attention. She also mentioned the fact that the limited number of problems allows drill and practice without frustration. It was noted by the second evaluator that the step by step approach was very helpful to the student in arriving at the correct response.

At the end of the school year, the students in the target group were given a follow-up test by their classroom teacher. For promotion, the teacher had to certify that the students mastered the skills that they failed in October. The end of the year evaluations were compared to the results obtained by the writer of this practicum. Please refer to Table 2 on page 28. Student A and C did not pass the author's test with 80% accuracy. Student A also did not pass the classroom teacher's test with 80% accuracy and was retained in third grade. Student C did pass the classroom teacher's test with 80% accuracy and was promoted to fourth grade. Student H did pass the author's test with 80% accuracy but did not pass the classroom teacher's test and was retained in third grade. All of the other students in the target group passed the author's test and the classroom teacher's test and were promoted to fourth grade. Of the nine students in the target group,

seven passed the end of the year test and were promoted to fourth grade; two didn't pass and were retained.

RECOMMENDATIONS

At the end of the school year, the classroom teacher administered a required follow-up test to the students in the target group. The author of this practicum checked the results of this test to ascertain the effectiveness of the author's remediation. It was found that the computer program and the remediation associated with it was beneficial to 7 of the 9 students in the target group. It is the recommendation of this writer that the computer program and its documentation be used with all of the children in the third grade prior to the administration of the state assessment test in October. This should be done to determine whether its use will result in an improvement of the test scores for the particular skill in question. It should be remembered that the score for the overall school was 67% in the area of money and the making of change.

The computer program and the additional materials developed as part of the solution strategy were shared with other third grade teachers as well as with teachers of other grade levels. The teachers recommended that the computer program be used with students in the other third grade classes in the school. The program was donated to the computer lab of the school in which this practicum was implemented. The computer program was made available to other schools by the writer of this practicum.

The writer offered to donate the computer program to the public domain catalog of the county school district in which

the author teaches. The computer program was accepted as being an excellent addition to the county's software collection. The computer program can now be ordered by county teachers for use in their classrooms (Appendices K and L contain letters concerning this acceptance).

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APPENDIX A

County Minimum Standards

Last First

SID #

APPENDIX A

*Mastery will comp a School Board promotion policy.

✓Indicates Mastery.

MATHEMATICS

Minimum Basic Skills

W1900

School School School School

KINDERGARTEN

Teacher Signature Year

Teacher Signature Year

SKILLS

— A1 Recognizes sets containing zero through five members
— A2 Constructs sets with zero through five members
— A3 Counts through ten
— B1 Recognizes the numerals 0 through 5
— D1 Shows the order of numbers zero through 5
— D2 Compares quantities using the words: as many as more, less, most,least
— O1 Understands size relationships: long, longer, short, shorter, (same length)

GRADE ONE

Teacher Signature Year

Teacher Signature Year

SKILLS

— A4 Associates numbers, zero through nine, with sets
— A5 Counts to nineteen
— A6 Counts by ones to fifty
— B2 Recognizes and writes the numerals 0 through 9
— B3 Writes two digit numerals through 50
— D3 Orders the numbers zero through nine
— D4 Compares numbers zero through nine using the concept greater than; less than; one greater than; one less than
— E1 Recognizes one-half
— F1 Adds using vertical and/or horizontal forms, sums 12 and less
— F2 Add three addends, sums through ten
— G1 Subtracts using horizonal and vertical forms, sums through 12
— O2 Tells time on the hour
— P1 Identifies a circle, square, and triangle
— Q1 Recognizes and indentifies the value of a penny, nickel and dime

GRADE TWO

Teacher Signature Year

Teacher Signature Year

SKILLS

— A7 Counts the number of objects in a set of no more than 100 objects
— B4 Reads and writes numerals for whole numbers less than 100
— B5 Reads and writes word names for whole numbers zero through ten
— D5 Identifies the smaller or larger of any two given whole numbers less than 20
— D6 Writes the numeral that comes just before any whole number less than 100
— D7 Writes the numeral that comes just after any given whole number less than 100
— D8 Identifies the ordinal position of any object in a set of no more than 10 objects using a reference point
— D9 Writes the numeral that comes between any two given whole numbers less than 100
— E2 Identifies one-half, one-third, or one-fourth of a given region
— F3 Adds two 1-digit numbers (basic facts), given in vertical and horizontal notation
— F4 Adds any three 1-digit numbers, sums through 18, given in vertical and horizontal notation
— F5 Adds a 2-digit number to a 2-digit number, without regrouping, given in vertical and horizontal notation
— F6 Adds a 1-digit number to a 2-digit number, without regrouping, given in vertical and horizontal notation
— G2 Subtracts basic facts, sums through 18, given in vertical and horizontal notation
— G3 Subtracts 1-digit number from a 2-digit number, without regrouping, given in vertical and horizontal notation
— G4 Subtracts any two 2-digit numbers, without regrouping, given in vertical and horizontal notation
— I1 Groups twelve or fewer objects into sets of equal amounts (no remainders)
— O3 States orally the days of the week in consecutive order
— O4 Selects a clock that shows a stated time on the hour and half-hour
— O5 Determines the length of an object in whole units given a unit of measurement (inch, centimeter, non-standard)
— P2 Identifies a circle, square, triangle, & rectangle

Grade Two (cont.)

— Q2 Identifies a set of coins equivalent in value to a given set of coins with the value not to exceed 25¢
— T1 Solves real-world problems involving addition of two 1-digit or two 2-digit numbers, without regrouping
— T2 Solves real-world problems involving subtraction of two 1-digit or two 2-digit numbers, without regrouping
— V1 Uses addition without regrouping to solve real world problems involving two purchases totaling no more than 50¢
— V2 Uses subtraction without regrouping to solve real world problems involving no more than 50¢

GRADE THREE

Teacher Signature Year

Teacher Signature Year

SKILLS

— A8 Identifies the number of objects in a set of no more than 500 objects
— B5 Reads and writes the numerals for any given whole number through 1000
— B6 Reads and writes money values through one dollar
— D9 Puts in order any three whole numbers less than 100
— D10 Identifies the ordinal position of any object in a set of 11 through 50 objects using a reference point
— E3 Identifies equivalent fractional parts of regions that have been separated into halves, thirds, or fourths
— E4 Identifies one-half, one third, or one-fourth of a set having more than 8 objects, with no remainders
— F7 Adds two 3-digit numbers, without regrouping
— F8 Adds two 3 digit numbers, with regrouping
— G5 Subtracts a 1-digit from a 2-digit number, with regrouping
— G6 Subtracts any two 2-digit numbers, with only one regrouping
— H1 Writes basic multiplication facts, products through 25
— I2 Writes basic division facts, products through 25
— O6 Measures lengths to the nearest centimeter
— O7 Measures lengths to the nearest inch
— Q3 Determines equivalent amounts of up to one dollar using coins
— T3 Determines solutions to real-world problems involving additions of up to two 2-digit numbers
— T4 Determines solutions to real-world problems involving subtraction of two 2-digit numbers with no regrouping
* V3 Determines the change to be received from up to 50¢ after the purchase of two items

APPENDIX B

State Minimum Standards

APPENDIX 3

DISTRICT: [illegible] COUNTY
SCHOOL: [illegible]
CLASS: (04 A)
OCTOBER 1984

No. of Students
7636
78

LISTING O.
1984-1985 STATEWI
FLORIDA DEPA

SKILL ACHIEVEA

| SUBJECT | MATHEMATICS | | |

APPENDIX C

Principal's Letter

THE SCHOOL BOARD OF APPENDIX C COUNTY, FLORIDA

ELEMENTARY SCHOOL

March 25, 1985

To Whom It May Concern:

Please be advised that an item on the standardized achievement test, CAT, indicated that the third grade children needed additional assistance in understanding money and making change. Computers are available in the school which could be used for additional instruction in this area. However, there are limited funds for the purchase of software. Therefore, it would be helpful for Amy Pettit to conduct her practicum in this curriculum area.

Respectfully yours,

Principal

NML:jm

Equal Opportunity Employer, Using Affirmative Action Guidelines

APPENDIX D

Teachers' Letters

THE SCHOOL BOARD OF COUNTY, FLORIDA

45

ELEMENTARY SCHOOL
Principal

April 17, 1985

To Whom It May Concern:

The third grade children in my math class need additional assistance in understanding money and the making of change. This need was indicated by the test scores on the standardized achievement test, CAT. Although there are computers in the school the software available is not appropriate. There are limited funds to purchase any additional software. Therefore, it would be beneficial for Amy Pettit to conduct her practicum in this curriculum area.

Respectfully yours,

Third Grade Teacher

PF:jm

Opportunity Employer, Using Affirmative Action Guidelines

THE SCHOOL BOARD OF COUNTY, FLORIDA

ELEMENTARY SCHOOL
Principal

April 17, 1985

To Whom It May Concern:

The third grade children need additional assistance in understanding money and the making of change. This need was indicated by the test scores on the standardized achievement test, CAT. Although there are computers in the school the software available is not appropriate. There are limited funds to purchase any additional software. Therefore, it would be beneficial for Amy Pettit to conduct her practicum in this curriculum area.

Respectfully yours,

Primary Specialist

JH:jm

Opportunity Employer, Using Affirmative Action Guidelines

THE SCHOOL BOARD OF APPENDIX D ~~COUNTY~~, FLORIDA

ELEMENTARY SCHOOL

April 17, 1985

To Whom It May Concern:

The third grade children need additional assistance in understanding money and the making of change. This need was indicated by the test scores on the standardized achievement test, CAT. Although there are computers in the school the software available is not appropriate. There are limited funds to purchase any additional software. Therefore, it would be beneficial for Amy Pettit to conduct her practicum in this curriculum area.

Respectfully yours,

Computer Teacher

LM:jm

Equal Opportunity Employer, Using Affirmative Action Guidelines

APPENDIX E

Attitudinal Questionnaire Before Instruction

QUESTIONNAIRE

Please answer the following questions by circling YES if you agree or NO if you do not agree. There are no 'right' or 'wrong' answer.

1. I know how to do word problems involving money and making change. (YES) NO
2. I like to use computers to learn about mathematics. (YES) NO
3. Math is my best subject. (YES) NO
4. I understand how to do math word problems. (YES) NO
5. I know how to estimate when doing math problems. YES (NO)

QUESTIONNAIRE

Please answer the following questions by circling YES if you agree or NO if you do not agree. There are no 'right' or 'wrong' answer.

1. I know how to do word problems involving money and making change. YES NO
2. I like to use computers to learn about mathematics. YES NO
3. Math is my best subject. YES NO
4. I understand how to do math word problems. YES NO
5. I know how to estimate when doing math problems. YES NO

QUESTIONNAIRE

Please answer the following questions by circling YES if you agree or NO if you do not agree. There are no 'right' or 'wrong' answer.

1. I know how to do word problems involving money and making change. YES NO

2. I like to use computers to learn about mathematics. YES NO

3. Math is my best subject. YES NO

4. I understand how to do math word problems. YES NO

5. I know how to estimate when doing math problems. YES NO

QUESTIONNAIRE

Please answer the following questions by circling YES if you agree or NO if you do not agree. There are no 'right' or 'wrong' answer.

1. I know how to do word problems involving money and making change. YES NO
2. I like to use computers to learn about mathematics. YES NO
3. Math is my best subject. YES NO
4. I understand how to do math word problems. YES NO
5. I know how to estimate when doing math problems. YES NO

QUESTIONNAIRE

Please answer the following questions by circling YES if you agree or NO if you do not agree. There are no 'right' or 'wrong' answer.

1. I know how to do word problems involving money and making change. (YES) NO
2. I like to use computers to learn about mathematics. (YES) NO
3. Math is my best subject. (YES) NO
4. I understand how to do math word problems. YES NO
5. I know how to estimate when doing math problems. YES (NO)

QUESTIONNAIRE

Please answer the following questions by circling YES if you agree or NO if you do not agree. There are no 'right' or 'wrong' answer.

1. I know how to do word problems involving money and making change. YES NO

2. I like to use computers to learn about mathematics. (YES) NO

3. Math is my best subject. YES (NO)

4. I understand how to do math word problems. YES NO

5. I know how to estimate when doing math problems. (YES) NO

QUESTIONNAIRE

Please answer the following questions by circling YES if you agree or NO if you do not agree. There are no 'right' or 'wrong' answer.

1. I know how to do word problems involving money and making change. (YES) NO
2. I like to use computers to learn about mathematics. (YES) NO
3. Math is my best subject. YES (NO)
4. I understand how to do math word problems. YES (NO)
5. I know how to estimate when doing math problems. (YES) NO

QUESTIONNAIRE

Please answer the following questions by circling YES if you agree or NO if you do not agree. There are no 'right' or 'wrong' answer.

1. I know how to do word problems involving money and making change. (YES) NO
2. I like to use computers to learn about mathematics. (YES) NO
3. Math is my best subject. (YES) NO
4. I understand how to do math word problems. (YES) NO
5. I know how to estimate when doing math problems. YES (NO)

QUESTIONNAIRE -

Please answer the following questions by circling YES if you agree or NO if you do not agree. There are no 'right' or 'wrong' answer.

1. I know how to do word problems involving money and making change. YES NO

2. I like to use computers to learn about mathematics. YES NO

3. Math is my best subject. YES NO

4. I understand how to do math word problems. YES NO

5. I know how to estimate when doing math problems. YES NO

APPENDIX F

Sample Test

MATHEMATICS GRADE THREE

FOR HAND SCORING ONLY

T 59
V 3

STUDENT NAME

STANDARD V: STUDENT WILL SOLVE MONEY PROBLEMS.

TEST CODE **300–334**

SKILL V3 MASTERY 3/4

SOLVE PROBLEMS

9. Billy had 35¢ for supplies. He bought paper for 15¢ and a pencil for 10¢. How much money does Billy have left?

60¢	10¢	25¢	20¢
Ⓐ	Ⓑ	Ⓒ	Ⓓ

11. Celia had 50¢ for lunch. She bought a hot dog for 20¢ and milk for 10¢. How much money did she have left?

20¢	30¢	80¢	40¢
Ⓐ	Ⓑ	Ⓒ	Ⓓ

10. John has 25¢ to spend. If he buys gum for 17¢ and candy for 8¢, how much money will he have left?

17¢	50¢	0¢	8¢
Ⓐ	Ⓑ	Ⓒ	Ⓓ

12. Mary went to the store and bought bread for 24¢ and a can of peas for 19¢. How much change did she get back from 50¢?

31¢	43¢	7¢	26¢
Ⓐ	Ⓑ	Ⓒ	Ⓓ

APPENDIX G

Parental Forms

PARENTAL CHECKLIST

_____ has done the following
student name

activities with me concerning money and the making of change:

(Please explain briefly what you have done)

10¢ 50
15¢ - 15
15 35

20¢ 5
+10¢ - 30
30 - 20

5 50
5 - 10
10 - 40

_____ (does / does not) understand
student name

what we have done.

_____
parent signature

Additional Comments:

PARENTAL CHECKLIST

_____ has done the following
student name

activities with me concerning money and the making of change:
(Please explain briefly what you have done) (50 cents or less)

We made change from items that we purchase at the store. Ex. he had 50¢ he purchase a bag of chips for 35¢, he told me that he had 15¢ left. We also went through different ways in adding up 50¢.

$$\begin{array}{r} 50 \\ -\ 35 \\ \hline 15¢ \end{array}$$

_____ (does / does not) understand
student name

what we have done.

~~Betty Standish~~
parent signature

Additional Comments:

I will have to work with + ~~-~~ some more on counting money, and how much change he gets back, he seems to have some difficulty in subtration in taking one number from another

PARENTAL CHECKLIST

[redacted] has done the following
student name

activities with me concerning money and the making of change:
(Please explain briefly what you have done) 50 cents in coins
I gave her a quarter, two dimes and nickel
and had her to add them one by one. Then I took
them away one by one.

[redacted] (does / does not) understand
student name

what we have done.

[redacted]
parent signature

Additional Comments:

PARENTAL CHECKLIST

_____ has done the following
student name

activities with me concerning money and the making of change:
(Please explain briefly what you have done)

had 80¢. She bought 1 candy bar
at 25¢. How much money does
have now.

80
-25
55¢

_____ (does / does not) understand
student name

what we have done.

_____
parent signature

Additional Comments:

John had 65¢ he spent 35¢
how much money does John have now?

65
-35
30¢

PARENTAL CHECKLIST

[redacted] has done the following
student name

activities with me concerning money and the making of change:

(Please explain briefly what you have done)

[redacted] wanted to buy a [redacted] for 88¢, she had $1.00 in change. must must in change did she give and how much did she get back.

give 90¢ back 2¢

[redacted] (does / does not) understand
student name

what we have done.

[redacted]
parent signature

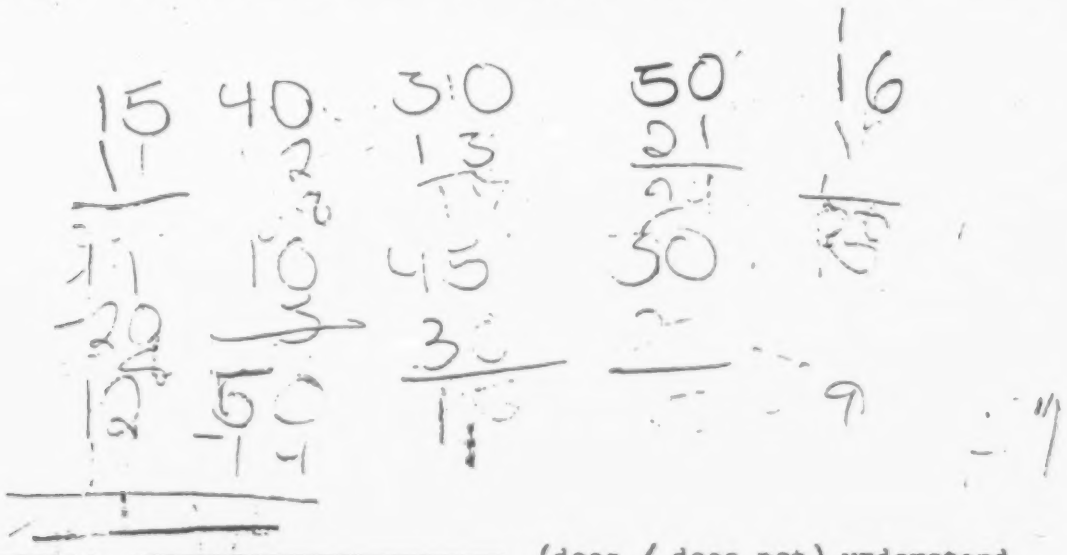
Additional Comments:

PARENTAL CHECKLIST

_____ has done the following
student name

activities with me concerning money and the making of change:

(Please explain briefly what you have done)



_____ (does / does not) understand
student name

what we have done.

_____
parent signature

Additional Comments:

APPENDIX H

Software Evaluations

Project SEED EVALUATION INSTRUMENT

Date submitted: _____ State Contact Person _____

Evaluator: [illegible]

PART I.

Producer: _____ Copyright Date: 1985

Title: Money Magic

Content Area: Math Presentation Mode: D/P X P/S ___ CMI ___

Specific Topics: making change SIM ___ GA ___ TU ___ CAI ___

_____ Other _____

Program Scope: K 1 2 (3) 4 5 6 7 8 9 10 11 12 Adult → for remediation

A. INDIVIDUAL PACKAGE CONTENTS:

No. of Disks 3 Package Price: not available

Guides none Network Version Available ? (yes / no)

Manuals [illegible] Network Version Price _____

Other _____

Documentation Available: Complete ___ Partial ___ None X

Series Title (if any): _____

Packages in Series: _____ Series Price: _____

B. SYSTEM REQUIREMENTS:

Computer Make/Model Apple II systems

Computer Versions Available: 1

Computer Version Operating System: Pilot (Super Pilot)

Memory Size: Minimum 48K ? Desired _____

Peripherals and Special Devices: Required (R) or Optional (O).

Color Monitor O Printer ___ 80-column card ___

Serial cards ___ Joysticks ___ Koala Pad ___

2nd Disk Drive ___ Other _____ ___

Other _____ ___ Other _____ ___

C. OTHER INFORMATION:

Preview Policy _____ Backup Policy _____

Copy Protection _____ Licensing Agreement _____

A. ACCESS: After entering the program, how does the user select less activity?

Menu _____; Pretest _____; Other X: (describe) program runs without user choice as to problems seen.

Pretest by Teacher _____: Other _____: (describe) _____

B. DESCRIPTORS:

INSTRUCTIONAL OBJECTIVES:

To help reinforce concept of making change.

INSTRUCTIONAL PREREQUISITES:

Classroom time must have been devoted to this skill so that students have learned the concepts of making change when purchasing 1 item vs 2 items.

POTENTIAL USERS/USES:

Remedial classes or compensatory education classes like SLD or Chapter I

MAJOR STRENGTHS:

Colorful graphics to attract the students' attention. Topic presented is a difficult concept and the limited number of problems presented allows drill & practice without frustrating the student.

MAJOR WEAKNESSES:

Children will need to use paper and pencil to do the problems

C. SUMMARY AND RECOMMENDATION:

Recommended X Not Recommended _____ Recommended, but with reservations _____

TO MY KNOWLEDGE, NO ATTEMPT HAS BEEN MADE TO COPY THIS PROGRAM.

12/10/85 _____ _____
Date Signature of Evaluator Phone Number

Computer Teacher

APPENDIX H

THE SCHOOL BOARD OF [illegible] COUNTY FLORIDA
Curriculum K-12 Department

COURSEWARE EVALUATION

PROGRAM

Program Title: Money Magic

Producer: _____

Copyright Date: 1985 Price: _____

Curriculum Area(s): Elem Math

Content Topic(s): _____

User: Grade/Ability Level _____

Instructional Purpose: Standard Instruction ✓ Enrichment ✓ Remediation ✓

Instructional Technique:

Drill and Practice	____	Management	____
Tutorial	____	Problem Solving	✓
Games	____	Other	_____
Simulation	____		_____

HARDWARE REQUIREMENTS

MANUFACTURER		MEMORY		DRIVES		PERIPHERALS	
Apple II	____	32K	____	Single Disk	✓	Printer	____
Apple II Plus	____	48K	____	Double Disk	____	Color Monitor	____
Apple IIe	____	64K	✓	Hard Disk	____	Cassette Player	____
Other	_____					Speaker Circuit	____
	_____					Other	_____
							_____

PROGRAM COMPONENTS

Number of disks	3	Other	_____
Manual	____		_____
Worksheets	____		_____

APPENDIX H

DOCUMENTATION

Check and rate each item available in the computer program or in the accompanying materials (i.e., Teacher's Guide, Supplementary Materials.)

	COMPUTER PROGRAM RATINGS		ACCOMPANYING MATERIALS RATINGS	
	Approp.	Inapprop.	Approp.	Inapprop.
Suggested Grade/Ability Level	____	____	____	____
Instructional Objectives	____	____	____	____
User Entry Level Competencies	____	____	____	____
Program Operating Instructions	____	____	____	____
Resource/Reference Information	____	____	____	____
Pre-Test	____	____	____	____
Post Test	____	____	____	____
Follow-up Activities	____	____	____	____

RATING OF PROGRAM COMPONENTS

Circle the number which best reflects your evaluation (1 being the lowest rating - 5 the highest.

1 - Not Applicable
2 - Strongly Disagree
3 - Disagree
4 - Agree
5 - Strongly Agree

CONTENT

1. The content is accurate	1 2 3 4 (5)
2. The content has educational value	1 2 3 4 (5)
3. The content is appropriate to the curriculum	1 2 3 4 (5)
4. The content is free of stereotypes (racial, sexrole, ethnic)	1 2 3 4 (5)
5. The content is free of spelling, punctuational, grammatical errors	1 2 3 4 (5)

INSTRUCTIONAL QUALITY

6. The purpose of the package is well-defined	1 2 3 4 (5)
7. The package achieves its defined purpose	1 2 3 4 (5)
8. The program is organized and presented sequentially in appropriate developmental steps	1 2 3 4 (5)
9. Presentation of content is clear and logical	1 2 3 4 (5)

APPENDIX H

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10. The level of difficulty is appropriate for the intended users	1	2	3	4	(5)
11. Use of the package has motivational effect	1	2	3	4	(5)
12. The package effectively stimulates student creativity	1	2	3	(4)	5
13. Feedback on student responses is appropriate for intended users	1	2	3	4	(5)
14. The learner controls the rate and sequence of presentation and review	1	2	3	4	(5)
15. Instruction is integrated with previous student experience	1	2	3	4	(5)
16. Graphics/color/sound are used for appropriate instructional reasons	1	2	3	4	(5)
17. The user support materials are comprehensive	1	2	3	4	(5)
18. The user support materials are effective	1	2	3	4	(5)
19. Information displays are effective	1	2	3	4	(5)

TECHNICAL QUALITY

20. The user can exit the program at any time	1	2	3	4	(5)
21. Intended users can easily and independently operate the program	1	2	3	4	(5)
22. The program appropriately uses relevant computer capabilities	1	2	3	4	(5)
23. The program is reliable in normal use	1	2	3	4	(5)
24. Teachers can easily handle the logistics of managing the program	1	2	3	4	(5)
25. Teachers can make changes or add to the content	(1)	2	3	4	5
26. User's performance record is available	1	2	3	4	5

OVERALL RATING: *Highly Recommended* ✓

Recommended _____

Not Recommended _____

COMMENTS:

"Money Magic" is an excellent well thought out logical program. It takes the student step by step solving money word problems. The graphics and use of color are excellent. This development [illegible] with young [illegible]

6/83

APPENDIX I

Attitudinal Questionnaire After Instruction

QUESTIONNAIRE

Please answer the following questions by circling YES if you agree or NO if you do not agree. There are no 'right' or 'wrong' answer.

1. I know how to do word problems involving money and making change. (YES) NO
2. I like to use computers to learn about mathematics. (YES) NO
3. Math is my best subject. (YES) NO
4. I understand how to do math word problems. (YES) NO
5. I know how to estimate when doing math problems. (YES) NO

QUESTIONNAIRE

Please answer the following questions by circling YES if you agree or NO if you do not agree. There are no 'right' or 'wrong' answer.

1. I know how to do word problems involving money and making change. YES NO
2. I like to use computers to learn about mathematics. YES NO
3. Math is my best subject. YES NO
4. I understand how to do math word problems. YES NO
5. I know how to estimate when doing math problems. YES NO

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2. I like to use computers to learn about mathematics. YES NO

3. Math is my best subject. YES NO

4. I understand how to do math word problems. YES NO

5. I know how to estimate when doing math problems. YES NO

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2. I like to use computers to learn about mathematics. YES NO
3. Math is my best subject. YES NO
4. I understand how to do math word problems. YES NO
5. I know how to estimate when doing math problems. YES NO

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3. Math is my best subject. YES NO
4. I understand how to do math word problems. YES NO
5. I know how to estimate when doing math problems. YES NO

APPENDIX I

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2. I like to use computers to learn about mathematics. YES NO

3. Math is my best subject. YES NO

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5. I know how to estimate when doing math problems. (YES) NO

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3. Math is my best subject. YES NO
4. I understand how to do math word problems. YES NO
5. I know how to estimate when doing math problems. YES NO

APPENDIX I

QUESTIONNAIRE - POSTTEST

Please answer the following questions by circling YES if you agree or NO if you do not agree. There are no 'right' or 'wrong' answer.

1. I know how to do word problems involving money and making change. YES NO

2. I like to use computers to learn about mathematics. YES NO

3. Math is my best subject. YES NO

4. I understand how to do math word problems. YES NO

5. I know how to estimate when doing math problems. YES NO

APPENDIX J

Computer Specialist's Letter

December 10, 1986

To Whom It May Concern,

For the past three years I have been teaching computer literacy to students in grades kindergarten through fifth grade at an elementary school in . County. This year I am also teaching compensatory education. While at a workshop for math compensatory education teachers, a teacher suggested that I get in touch with who was working on her practicum and who had developed a program on making change. I was able to contact and she graciously let me use her program, Money Magic, with my comp. ed. students.

I have used this program with fourth grade low level math students and have found it to be very helpful with reinforcment of this skill. Before using the program, the students had been making change for a number of class sessions and felt comfortable doing so. I demonstrated the program using a large screen TV so that all seven students could see how the program worked and so that I knew they were aware of what keys to use and of the program's format. The students were anxious to use the program on their own and the disk was used by each of the students individually.

The students liked the graphics which were items that the student would be interested in purchasing. This was just one example of how the program was oriented to the elementary student. The text was legible and the screen display was not confusing or distracting. The reading level of the text was appropriate to third or fourth grade students.

The positive and negative reinforcement sounds were in keeping with the feel of the program. Neither sound was over powering nor unpleasant.

The problems were presented in increasing difficulty and the student was given "help" clues when necessary.

I was very pleased that was willing to share her program with me because making change is a difficult concept for children to grasp. Additionally, most commercial software packages which deal with making change seem to stress what coins to use rather than the process itself.

I would recommend this program for purchase if it were to be made available.

Computer Teacher
Comp. Ed. Teacher
~~Elementary~~

APPENDIX K

County Acceptance Letter

APPENDIX K

COUNTY PUBLIC SCHOOLS

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BOARD ADMINISTRATION BUILDING

DR.
SUPERINTENDENT OF SCHOOLS

ASSOCIATE SUPERINTENDENT
BUREAU OF EDUCATION

COUNTY SCHOOL BOARD
CHAIRMAN
VICE-CHAIRMAN

August 14, 1985

Program Professor of Education
Director of Practicums
CED -
Fl

Dear

who is working on her degree at your institution, recently brought to our lab a program she developed as part of her practicum.

The program, "Money Magic," teaches the State Assessment skill B-3, which relates to calculating money and making change. The program does a fine job of teaching this skill. It is noteworthy for its graphics and general format.

has agreed to donate her program to our public domain catalog so that it can be ordered by our county teachers for use with their students. We feel it will be an excellent addition to our software collection.

Sincerely,

Director
Computer Education
and Technology

APPENDIX L

University Acceptance Letter

University
CENTER FOR THE ADVANCEMENT OF EDUCATION
Florida

August 19, 1985

Ms.
Director, Computer Education & Technology
County Public Schools
, FL

Dear Ms.

Thank you for your letter explaining how useful
practicum project "Money Magic" will be to the
County Public Schools.

We are very proud of work and she is to be congratulated on a fine job. We do hope that other University graduates from County will continue to contribute positively to instructional excellence in your system.

Sincerely,

, Ed.D.
Director of Practicums

CED:ff

cc:

Encl.

APPENDIX M
Documentation Packet

CONTENTS

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- STUDENT INSTRUCTIONS 5

STUDENT DIRECTIONS 6

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- PRETEST-POSTTEST 31
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INTRODUCTION

MONEY MAGIC consists of two disks that are designed to provide primary grade students with individualized instruction and practice in solving word problems. Disk one consists of a pretest-posttest for student assessment. Disk two is a student lesson disk. MONEY MAGIC is an easy to use program that places an emphasis upon a structured but flexible approach to problem-solving. It concerns itself with those problems having to do with money and the making of change. The skills employed in the program include reading, understanding, analyzing, estimating, and computing with regard to the solving of word problems.

The lessons in MONEY MAGIC have been carefully structured to ensure maximum learning. They deal with high-interest, applied topics and focus on real-life situations. Students are given the opportunity to solve problems that require analytical thinking. An inductive, step-by-step approach is used so that the student will be guided to a better understanding of the process of how to solve the problem.

The technological revolution of the last decade has made familiarity with computers a necessity. MONEY MAGIC provides a creative format to reinforce problem-solving skills while providing the student with hands-on practice in the use of the computer.

BEFORE YOU BEGIN

Equipment You Will Need

Apple II Plus/IIe (with at least 48K memory)

Color TV or monitor (see note)

Disk drive

Pretest- Posttest disk

MONEY MAGIC lesson disk

NOTE: A separate student lesson MONEY MAGIC disk is provided for Black and White monitors. The pretest-posttest can be used on either type of monitor.

Parts of a Computer

Keyboard - It looks likes a keyboard of a typewriter. It is used to input information into the computer.

Monitor - It looks like a television screen. Output from the computer is displayed on the screen. A television can be used as a monitor if you have an RF modulator attachment.

Disk Drive - It reads the information on the disk. Sometimes you need more than one disk drive.

Disk - It is like a thin record with a cover that protects it from scratches. It can be called a diskette or floppy disk.

Disk Care

1. Always keep the disk in its cover when not in use. Keep it free from dust.
2. When you are using a disk, only touch it on the label.
3. Avoid direct sunlight and extreme temperatures.
4. Write on the label before attaching it to your disk.
5. Keep disks away from phones, televisions, and magnets.
6. Don't insert or remove disks from the disk drive when the red light is on.

Removing the Disk

1. Make sure that the red "in use" light is not on.
2. Open the disk drive door and gently pull the disk towards you, holding only the label.
3. Put the disk back into its jacket.
4. Close the disk drive door.

CAUTION: NEVER REMOVE A DISK FROM THE DISK DRIVE WHILE THE RED "IN USE" LIGHT IS ON. THIS WILL DAMAGE THE DISK.

Procedures for using MONEY MAGIC (Teacher Instructions)

1. Follow Student Instructions on 'How to Load the Program'

2. Go to Teacher Menu. When 'enter password' appears on the screen, type in 'learning'. Under Teacher Menu choose Number 1 - Enter Class List. Enter tbe names of the students whom you wish to use the program. It should be remembered that entering a new class list will DELETE any previous list and the accompanying scores.

3. If you wish to add a student name after you have enteреd the class list, go to Teacher Menu - Add New Student.

4. To see a display of student names and scores for both the pretest and the posttest go to Teacher Menu - Display Class List.

5. Administer the Pretest to the students that have been entered to Class List. The students' scores will be recorded to disk automatically.

6. After the Pretest has been taken, instruct each student to use the Lesson Program until he/she feel confident enough to take the Posttest.

7. Administer the Posttest. Student scores will be recorded to disk automatically.

8. Each student will be able to take the Pretest and the Posttest only once.

9. It is recommended that each disk be reviewed before presenting it to the students.

Using The MONEY MAGIC Program (Student Instructions) to be read by the teacher if nesessary.

How to "LOAD" the Program

After you have choosen the desired disk:

1. Open the disk drive door by pulling outward on its bottom edge.

2. Take the disk out of the jacket; hold only the label. When using the Program Lesson use the disk marked "Black and White" if you do not have a color monitor or television.

3. Hold the disk with the label facing up and towards you.

5. Slowly insert the disk into the disk drive.

6. Close the disk drive door by pushing it downwards.

7. Turn the power switch on the back of the Apple computer to the ON position. It is located on the lefthand, backside of the computer. You will hear a 'beep' and the power light to the left of the space bar will light.

8. Turn on the monitor by pushing down on the button in the top right-hand corner. A green light will appear. If you are using a television, follow the instructions given for that particular set.

NOTE: It will take a minute or so for the program to appear on the screen. Please be patient.

Student Directions

IMPORTANT: Make sure you understand how to "LOAD" the program. If you do not, read them again or ask your teacher to read them to you.

1. Follow the directions as they are given to you in each of the programs.

2. When using the Pretest-Posttest disk remember:

   a. You must enter your name correctly.

   b. You must press return after each answer.

   c. You can take each test only once.

   d. You must answer each question.

3. When using the Lesson Disk remember:

   a. It will take a minute or so for the program to come on the screen.

   b. Press the Control and the C key to end the program.

   c. Sometimes you must add and subtract, sometimes, to find the answer.

   d. You will probably need paper and pencil to do the problems.

4. Do the Pretest-Posttest disk first, choosing Pretest under Student Menu.

5. Do the the Lesson Disk next.

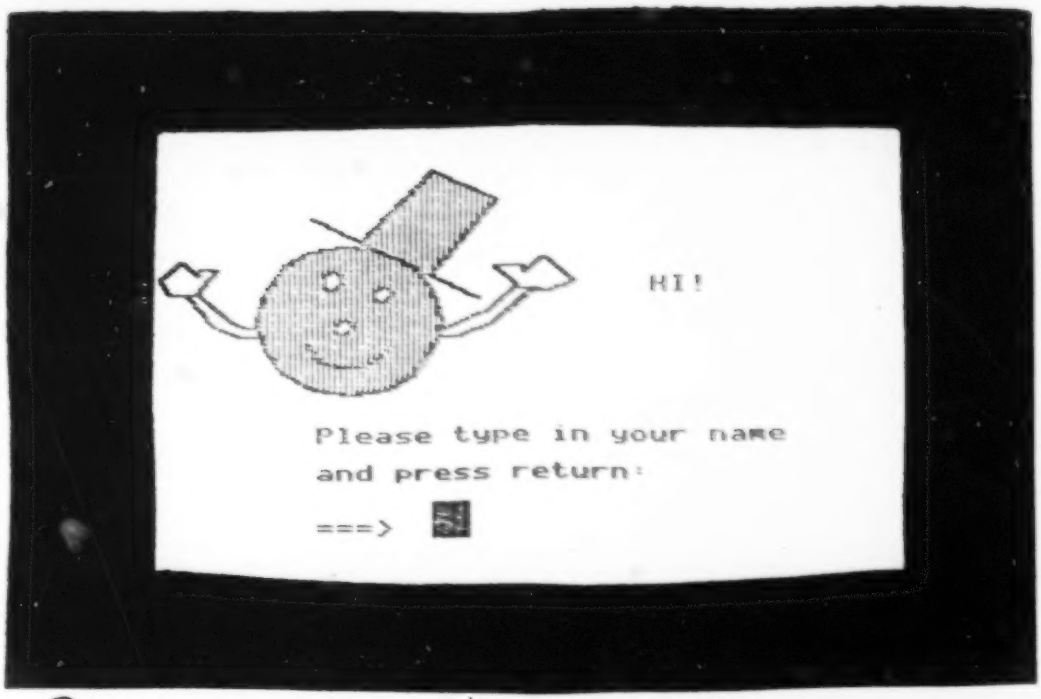
6. Do the Lesson Disk a few times until you understand how to do the problems.

7. Do the Pretest-Posttest disk, choosing Posttest under Student Menu.

8. You will not be able to do all of this in one day.

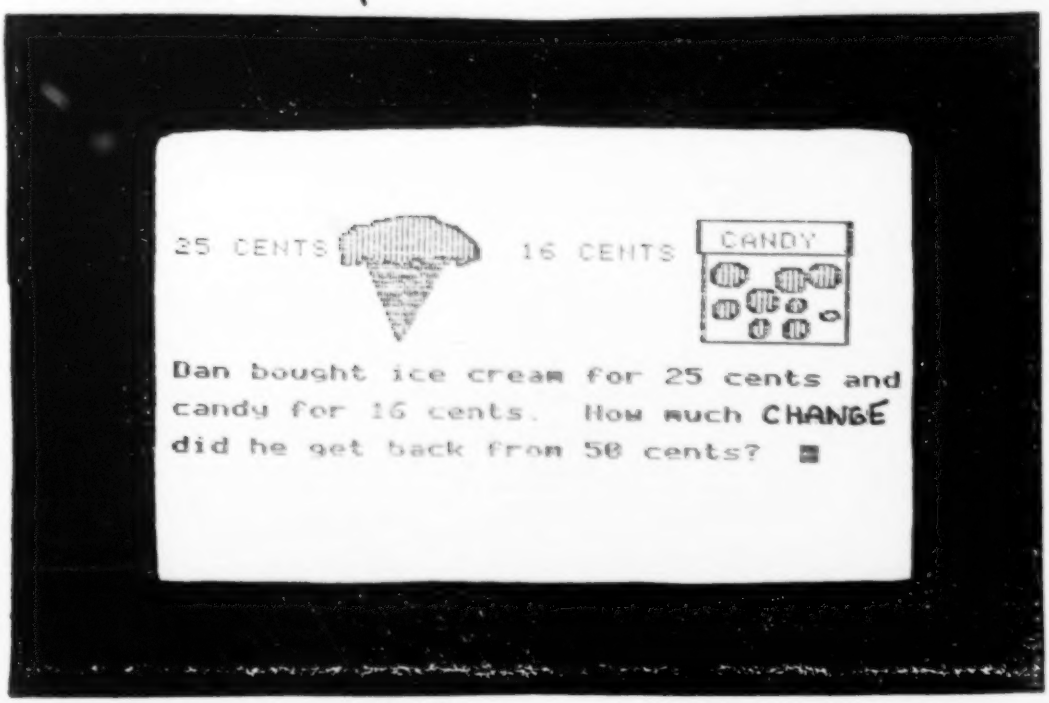
9. If you need any help, ask your teacher.

Screen Sample 1



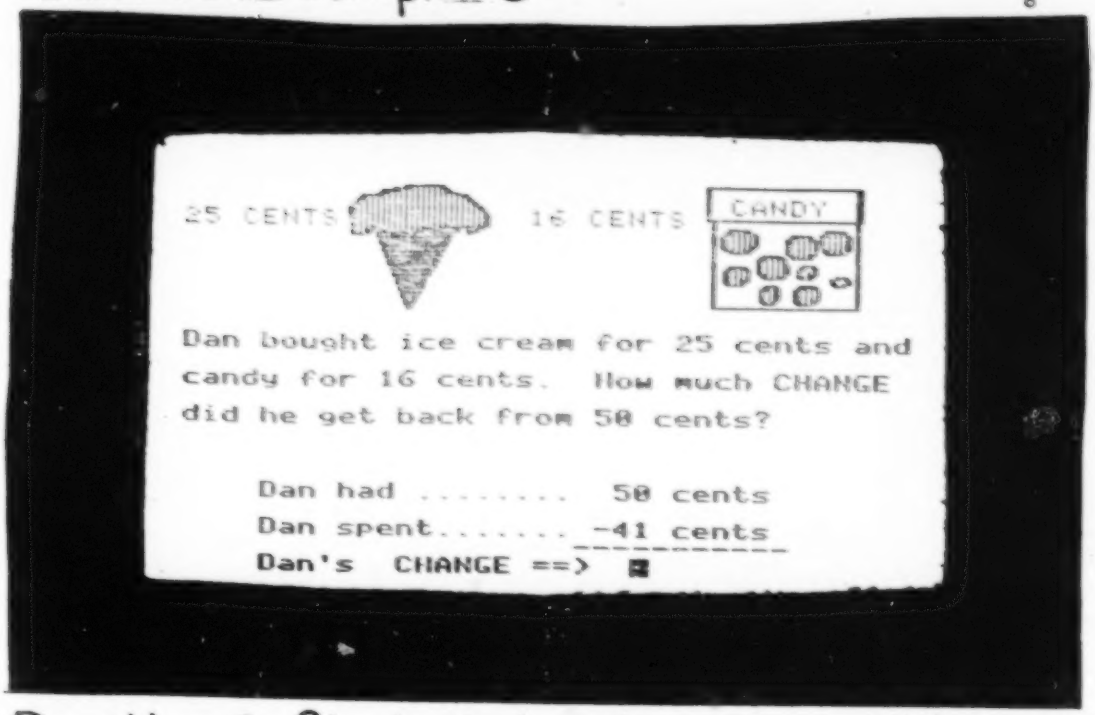
Student must type in his\her name.

Screen Sample 2


25 CENTS
16 CENTS
CANDY
Dan bought ice cream for 25 cents and
candy for 16 cents. How much CHANGE
did he get back from 50 cents?

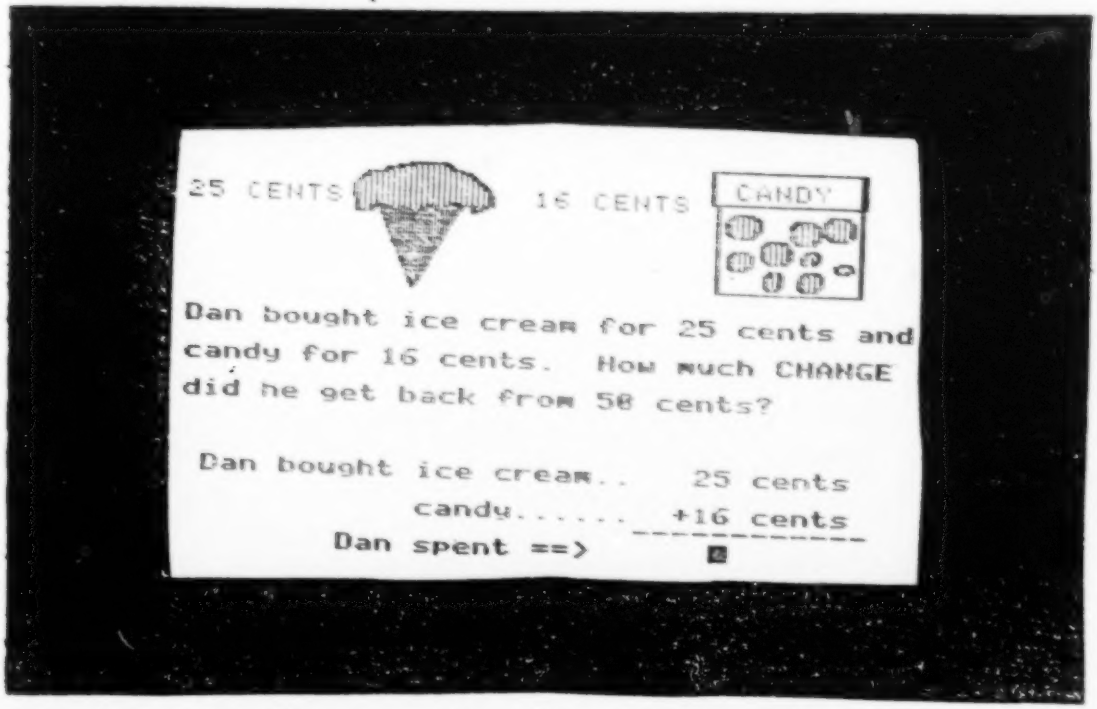
Question 2; student receives no help.

Screen Sample 3


25 CENTS
16 CENTS
CANDY
Dan bought ice cream for 25 cents and
candy for 16 cents. How much CHANGE
did he get back from 50 cents?
Dan had ..... 50 cents
Dan spent..... -41 cents
Dan's CHANGE ==>

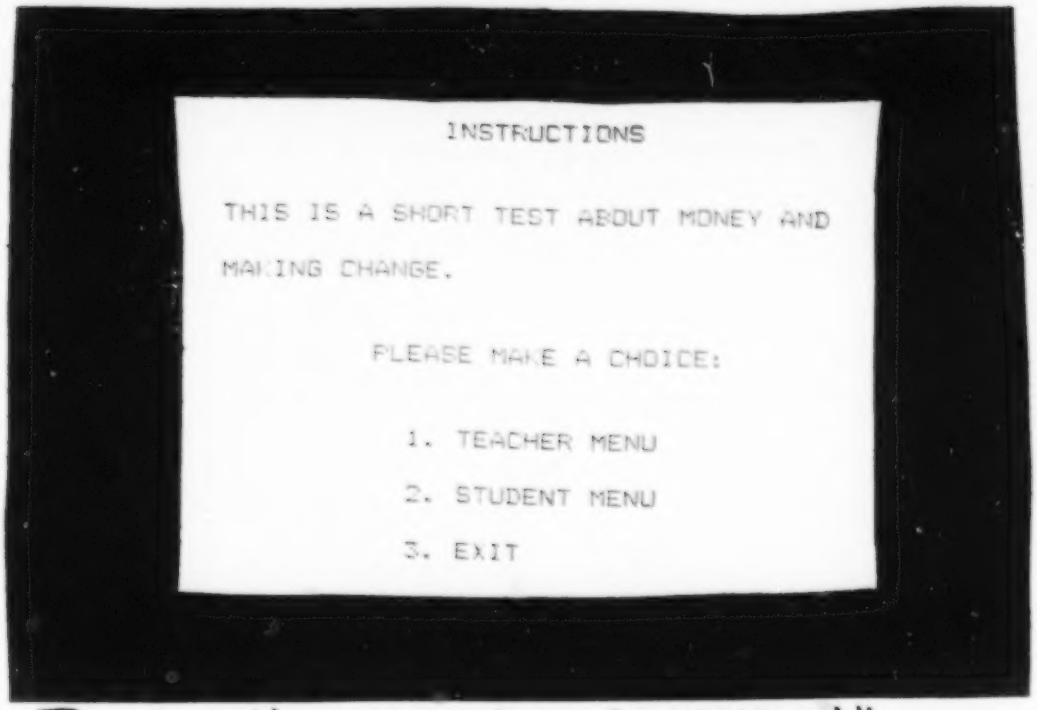
Question 2; Student is shown to add bought items

Screen Sample 4


25 CENTS
16 CENTS
CANDY
Dan bought ice cream for 25 cents and
candy for 16 cents. How much CHANGE
did he get back from 50 cents?
Dan bought ice cream.. 25 cents
candy..... +16 cents
Dan spent ==>

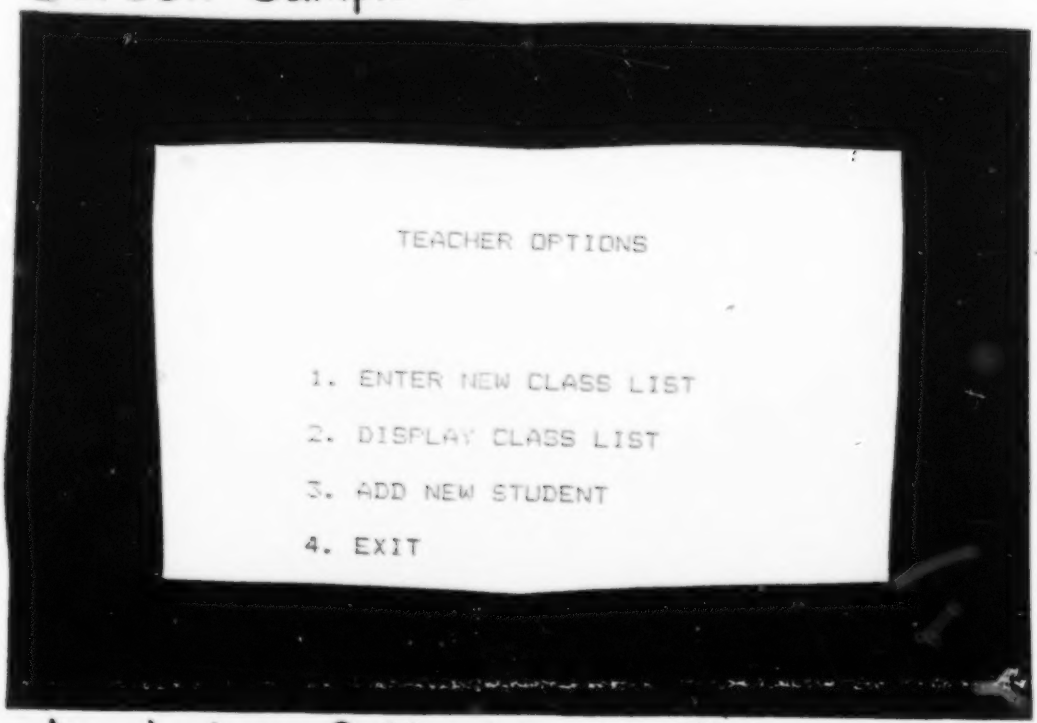
Question 2; Student is shown to subtract bought items from amount to spend.

Screen Sample 5



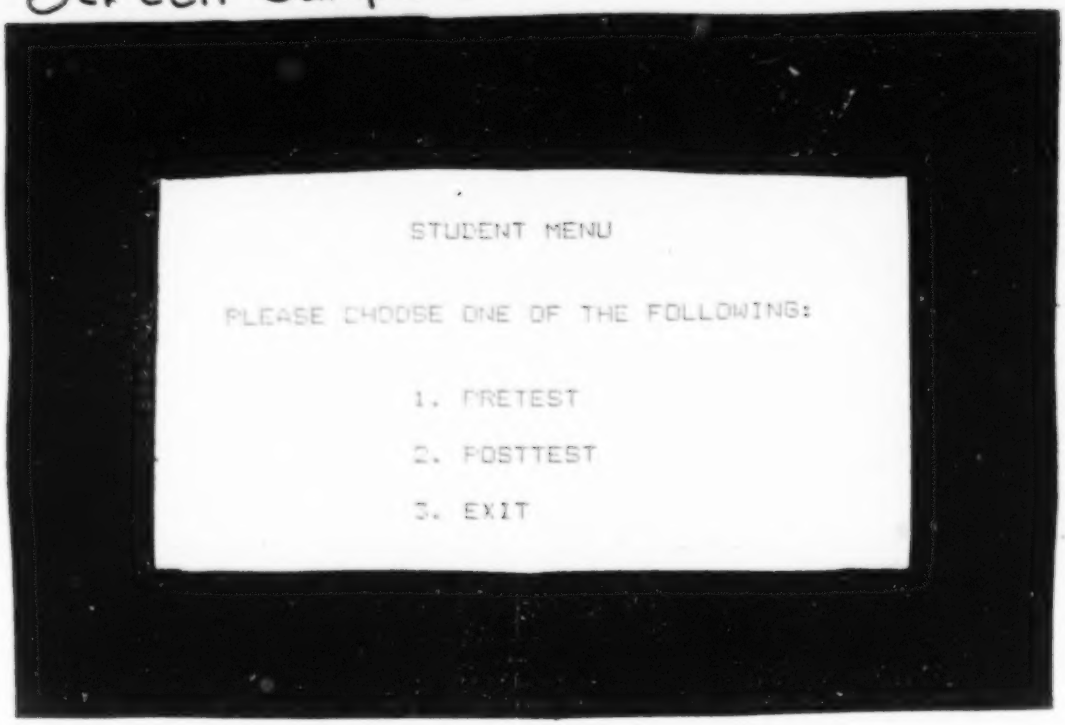
Teacher Menu requires "password".

Screen Sample 6

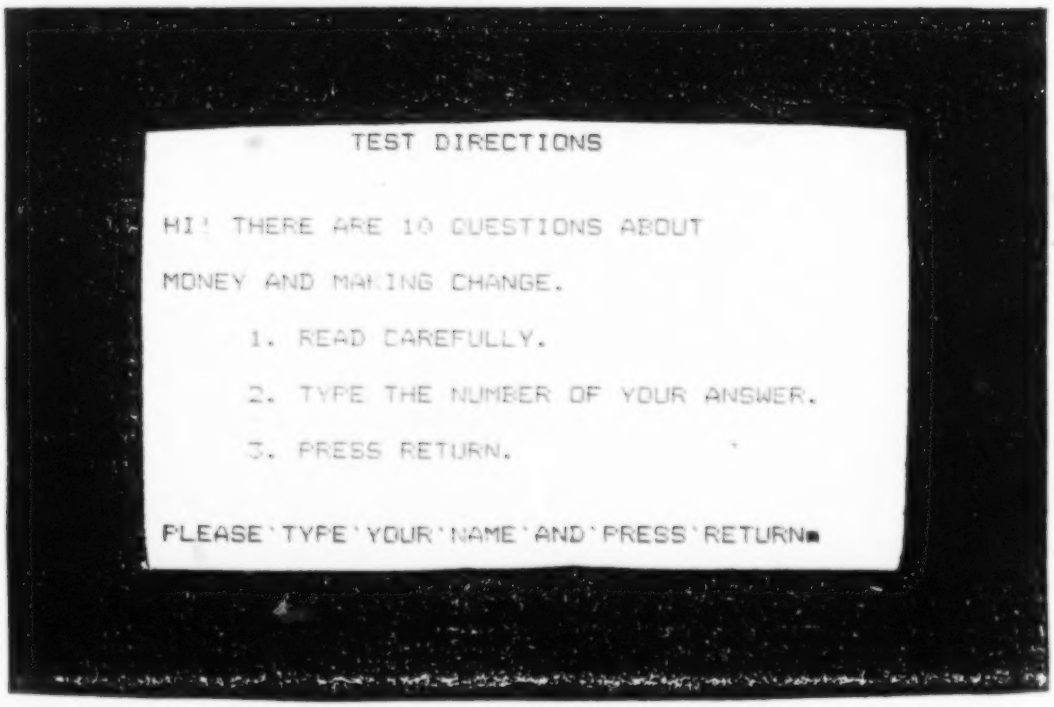


A choice of Number 1 will erase all previous information.

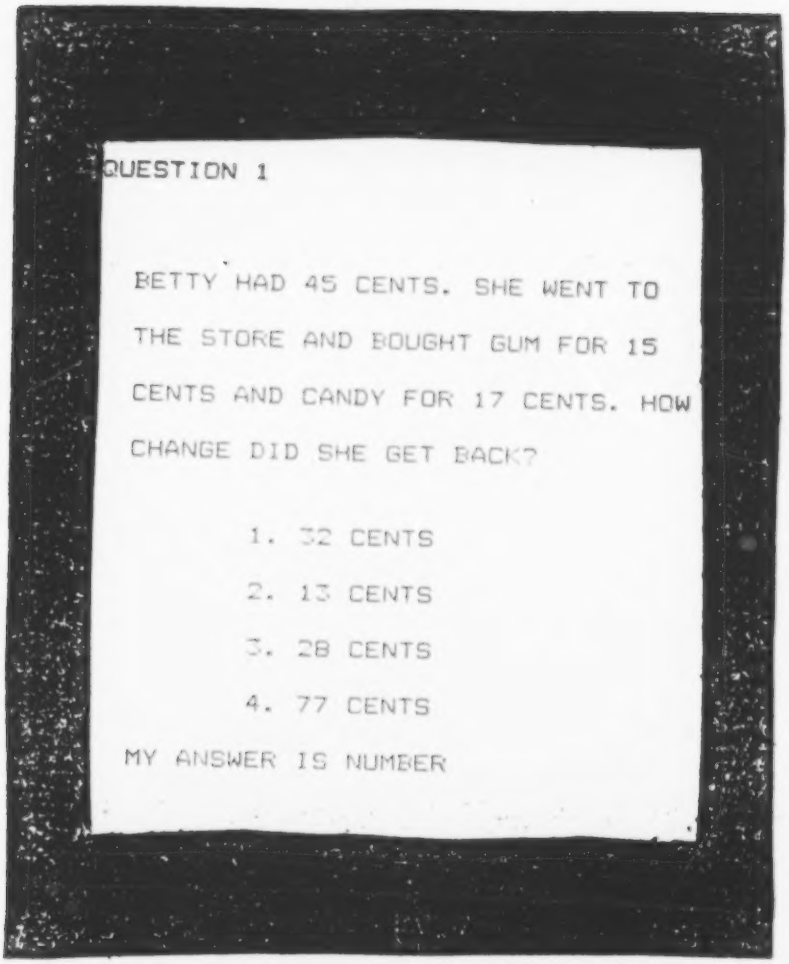
Screen Sample 7



Screen Sample 8


TEST DIRECTIONS
HI! THERE ARE 10 QUESTIONS ABOUT
MONEY AND MAKING CHANGE.
1. READ CAREFULLY.
2. TYPE THE NUMBER OF YOUR ANSWER.
3. PRESS RETURN.
PLEASE TYPE YOUR NAME AND PRESS RETURN

Screen Sample 9


QUESTION 1
BETTY HAD 45 CENTS. SHE WENT TO THE STORE AND BOUGHT GUM FOR 15 CENTS AND CANDY FOR 17 CENTS. HOW CHANGE DID SHE GET BACK?
1. 32 CENTS
2. 13 CENTS
3. 28 CENTS
4. 77 CENTS
MY ANSWER IS NUMBER

A sample question from the Pretest - Posttest.